Proactive Planning for Generation Interconnection

A Case Study of SPP and MISO

TEASER FOR

ENERGY SYSTEMS INTEGRATION GROUP

PRESENTED BY

The Brattle Group

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Brattle

About the Study

This Study looks at how the Generation Interconnection (GI) process can benefit from a higher level of proactive planning.

- The Study looks at three levels of proactive-ness using the MISO and SPP regions (or sub-regions) as testbeds.

Levels	Proactive-ness	Description
Level 1	Low	Status quo, where GI studies are performed on an annual basis.
Level 2	Medium	GI studies are performed on over multiple years (3 years).
Level 3	High	GI studies are performed on over multiple years (5 years) together with other transmission enhancements.

Higher numbers / darker shade of blue indicate higher levels of proactive-ness.

- This Study attempts to illustrate (and quantify) the benefits of proactive GI planning.
  - It is not a substitute for an interconnection engineering study.
  - It does not consider restudies as part of the process.
  - It does not address cost allocation or the current provisions for participant funding vs. crediting for interconnection-related upgrades.

Three Levels of Proactive GI Planning

Objective: Quantify benefits of proactive GI planning using a comparison across three levels of "proactive-ness."

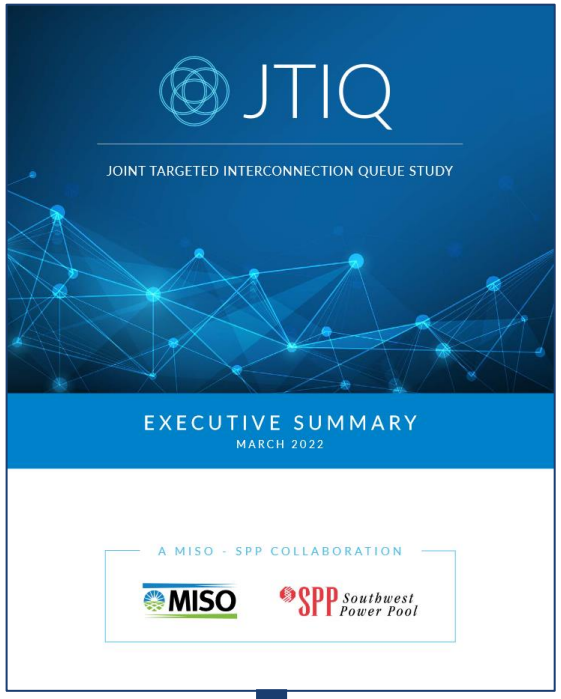
LEVEL 1: LOWER LEVEL OF PROACTIVE GI PLANNING	LEVEL 2: MEDIUM LEVEL OF PROACTIVE GI PLANNING	LEVEL 3: HIGHER LEVEL OF PROACTIVE GI PLANNING
Represents the status quo, where RTO/ISOs and utilities study GI on an annual (or semi-annual) basis.	Represents a multi-year (3 years) study window, rather than a single (or half a) year.	Represents a multi-year (5 year) study window together with other transmission enhancements (MISO-SPP Joint Targeted Interconnection Queue Study is a prime example).

Illustrative Example of the 3 Levels of Proactive Planning (SPP)

Level 1 →	6 months, 1,000-5,000 MW of interconnection projects
Level 2 →	2-3 years, ~15,000 MW of interconnection projects
Level 3 →	5 years, ~40,000 MW of interconnection projects

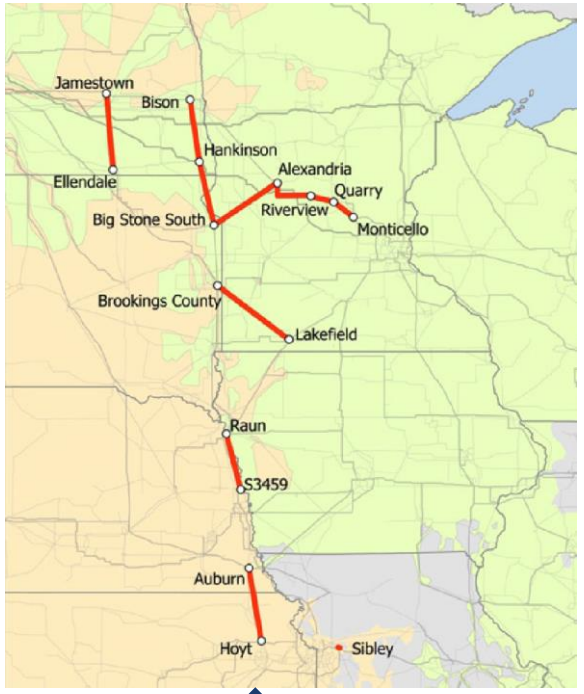
MISO-SPP Joint Targeted Interconnection Queue Study

Utilize the MISO-SPP Joint Targeted Interconnection Queue (JTIQ) study to represent **Level 3** (higher level of proactive planning).



- JTIQ aims at building transmission network upgrades along the MISO-SPP seams to enable new GI.
- This is achieved by identifying transmission constraints that limit new GI, comparing best solutions, and sharing costs among generators and load.
- JTIQ analyzes two time horizons: 5 years ahead and 10 years ahead. This Study focuses on the 5 years-window.

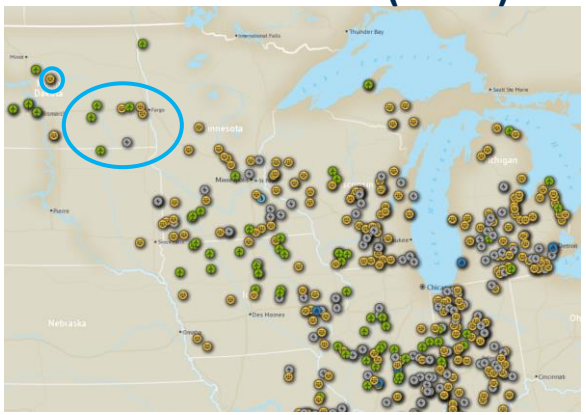
JTIQ identified seven transmission projects (JTIQ Portfolio) along the MISO-SPP seam costing $1.65 billion, which fully address constraints and further allow 28.6 GW of new GI projects (Energy Resource Interconnection Service, or ERIS, equivalent).



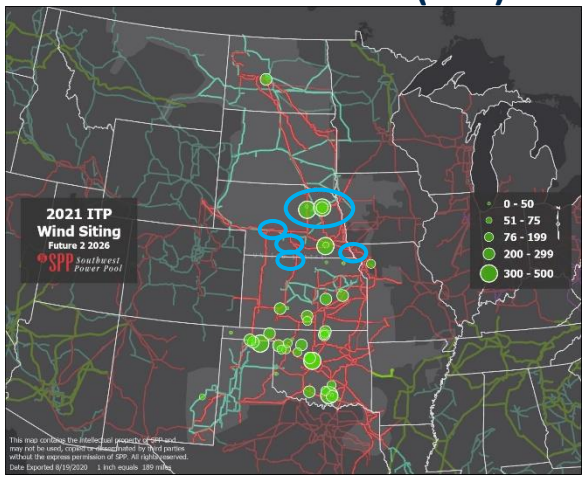
Analyzing the Benefits of Proactive Planning

1. Identify area/region to analyze.
   - The MISO and SPP regions were selected because the JTIQ study would represent **Level 3** (higher level of proactive-ness).
     - Within MISO/SPP, Eastern Nebraska (SPP) and Eastern Dakotas (MISO) were selected.
2. Analyze **Level 1** (lower level of proactive planning) using existing GI studies.
3. Develop **Level 2** (medium level of proactive-ness) case for target area/regions.
   - Create interconnection solutions for projects from 3 years of GI queue.
     - 959 MW from Eastern Nebraska and 2,290 MW from Eastern Dakotas analyzed.
     - Analyze MISO/SPP power flow cases to develop solutions (Base Case and N-1 assessments).
     - Utilize MISO/SPP generic cost estimates to tally costs for solutions developed.
4. Analyze **Level 3** (higher level of proactive planning) using the JTIQ study results.
5. Calculate and compare normalized GI costs among the three levels.
   - **Level 1** (lower level) and **Level 2** (medium level) cases.
     - Potential benefits of multi-year planning (3 years) vs. single year planning.
   - **Level 2** (medium level) and **Level 3** (higher level) cases.
     - Potential benefits of difference in multi-year planning (3 years vs. 5-year planning).
     - Additional benefits of difference in study scope identified in the JTIQ Study.

Eastern Dakotas (MISO)



Eastern Nebraska (SPP)

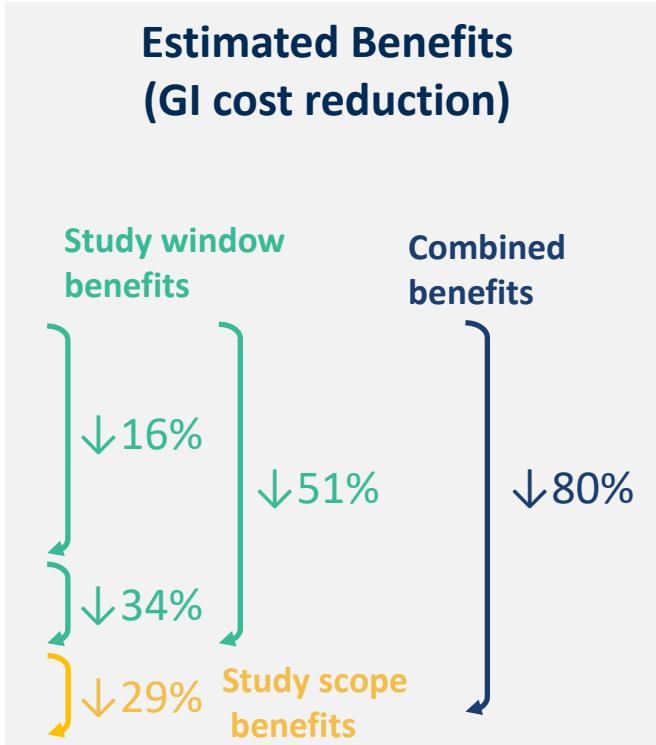


Study Results - Summary

Proactive GI planning provides significant cost reduction time-wise (benefits potentially growing exponentially with expanded study window of the GI studies) and scope-wise.

Benefits of Proactive GI Planning

Cases	Description	Study Window	MW Added	Cost ($ million)	Cost ($/kW)
LEVEL 1	SPP cluster studies (2017)	0.5 Years#	5,082	$552*	$109
	MISO cluster studies (2017-2018)	1 Year	5,025	$633*	$126
	SPP+MISO	1 Year	10,107	$1,185	$117
LEVEL 2	SPP multiple years cluster	3 Years	960	$91	$95
	MISO multiple years cluster	3 Years	2,290	$226	$99
	SPP+MISO	3 Years	3,249	$317	$98
LEVEL 3	JTIQ	5 Years	28,600	$1,650	$58
	JTIQ – adjusting for APC benefits	5 Years	28,600	$679	$24

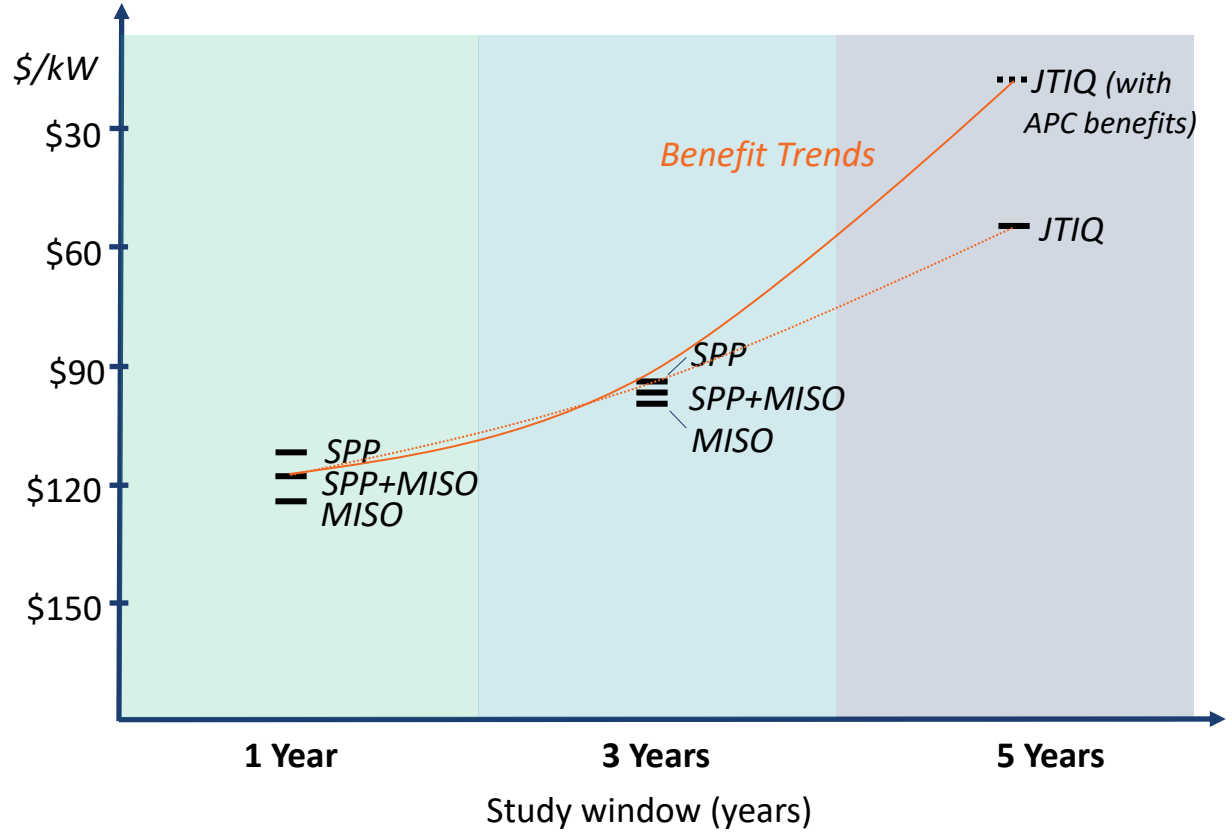


Notes:
*: Costs assume ERIS, and where noted (*) include affected system upgrades.
#: SPP recently changed two 1 year study windows.

Study Results - Observations

Proactive GI planning grows in a non-linear fashion with expansion of study window and scope.

Extending the study window from 1 to 5 years could ***reduce the GI cost to nearly half***, or even ***down to a fifth*** if GI and other transmission needs are co-optimized. While a ***JTIQ-like proactive GI approach is recommended*** in the longer-run, extending the study window may be a suggested improvement that can be implemented quickly.



Benefits measured in GI cost reduction (%)

Study window extension benefits

- By 2 years (from 1 to 3 years): 16%
- By 4 years (from 1 to 5 years): 51%

This suggests exponential growth in benefits as study window is expanded. However, there may be a natural limit because many renewable IR do not go beyond 4 to 5 years in the future. (See slide 23)

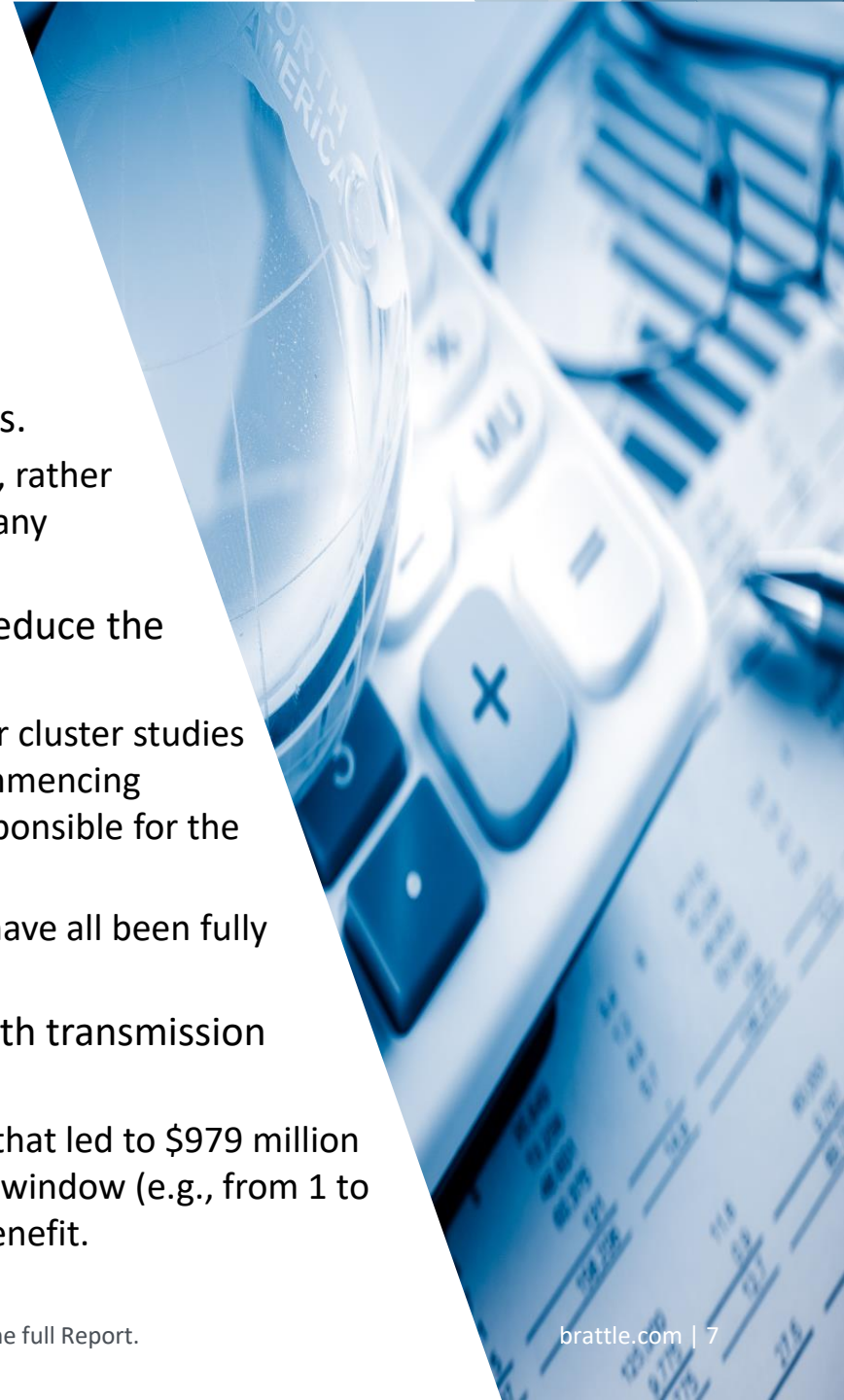
Study scope extension (APC) benefits: 29%

Without an allocation methodology, GI customers may not see this benefit.

Combined benefits: 80%

The combined benefit is what coordinated GI planning (as represented by JTIQ) can potentially realize.

Study Results - Qualitative Assessments



Proactive GI planning can help bridge the gap between short-term GI studies and long-term transmission planning studies while reducing the GI costs significantly.

- Study shows expanding the study window can lead to substantial reduction in GI costs.
  - Study shows exponential growth in benefits with the GI study window extended to 5 years, rather than 3 years, from the current single year process. This may not always be true because many renewable IRs are concentrated within the next few years (<5 years).
- A cost allocation mechanism that allows late-comers to pay their share would likely reduce the needs for restudies and allow for extending study windows.
  - FERC has approved tariff provisions (for MISO and NYISO) that require GI customers in later cluster studies that benefit from network upgrades completed prior to that later-in-time GI customer commencing commercial operation to partially reimburse the earlier cluster GI customer, who were responsible for the initial upgrade costs. Such policies would greatly support extending the study window.
  - Proactive transmission projects that successfully integrated large amounts of renewables have all been fully subscribed, suggesting the probability of underfunding may be minimal.
- Expanding the scope of the current GI studies, or combining/overlapping its scope with transmission planning, could further reduce GI costs.
  - Study illustrates expanding the study scope (represented by the AFS-like approach of JTIQ that led to $979 million APC benefits) could provide benefits that are equal to, or higher than expanding the study window (e.g., from 1 to 3 years.) However, without an allocation mechanism, GI customers may not receive that benefit.

Study Limitations

Scope: Focuses on proactive interconnection planning benefits

Intention was to evaluate multi-year planning (instead of change in study or geographical scope)

- This study is not a substitute for an interconnection engineering study.
- Study analyzes generic ERIS equivalent; Network Resource Interconnection Services (NRIS) benefits may differ (costs likely higher for deliverability upgrades).
- Considered baseline scenarios – no advanced technologies (Grid Enhancing Technologies, storage, HVDC etc.) were evaluated.

Assumption: Perfect foresight and no restudies

Renewable developments often are interested in the same location, meaning withdrawn projects don't impact the study

- This assumption is relevant for today where >90% of the GI queue is renewables.[1, 2]
- When projects withdraw, similar alternatives often will take their place later (as observed in the ERCOT CREZ lines, or SPP 345 kV collector system).
- Desirable renewable locations do not change much over time.

Limit: Does not address cost allocation or other GI issues

The study stops before considering cost allocation, resulting in uniform upgrade costs across projects

- Cost allocation varies system by system and can be difficult to generalize.
- The question of who pays and its mechanics (e.g., participant funding vs. crediting) is critical in solving the interconnection backlog.
- A thorough follow-up study for specific systems would be required to better understand the implications and practical implementation of proactive planning along with cost allocation.

1: Queued Up…But in Need of Transmission, Department of Energy: Office of Policy, April 2022

2: FERC's June 16, 2022 NOPR (Docket No. RM22-14-000) proposes a first ready-first serve base approach, which, if realized would likely reduce restudies.

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Proactive Planning Webinar

ESIG

WEBINAR

Webinar: Proactive Planning for Generator Interconnection: A Case Study of SPP and MISO

Bruce Tsuchida

Wednesday, August 17, 2022
4:00 - 5:00 pm (eastern US)

Featured Speaker: Bruce Tsuchida, Principal, The Brattle Group

Registration Cost: **FREE**

Abstract: This study, from the Proactive Planning Task Force, examines how costs vary in the generator interconnection (GI) process, depending on the level of proactive planning. It studies three levels of proactiveness using the MISO and SPP regions as testbeds. It finds significant cost reductions using expanded study windows and additional cost reductions with increased study scope.

About the Speaker: Mr. T. Bruce Tsuchida is a Principal of The Brattle Group with thirty years of experience in domestic and international power generation development, utility operation, and power market analysis. He specializes in assessing the impact of new technologies and regulatory changes, including analysis of evolving wholesale electric markets and modeling, impact of renewable and other new technologies' on system operations, utility business, and various impacts on valuations of transmission and generation assets, deliverability, and contracts. These studies range from large interconnected systems to small island systems.

Moderator **Debbie Lew** Associate Director, ESIG

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